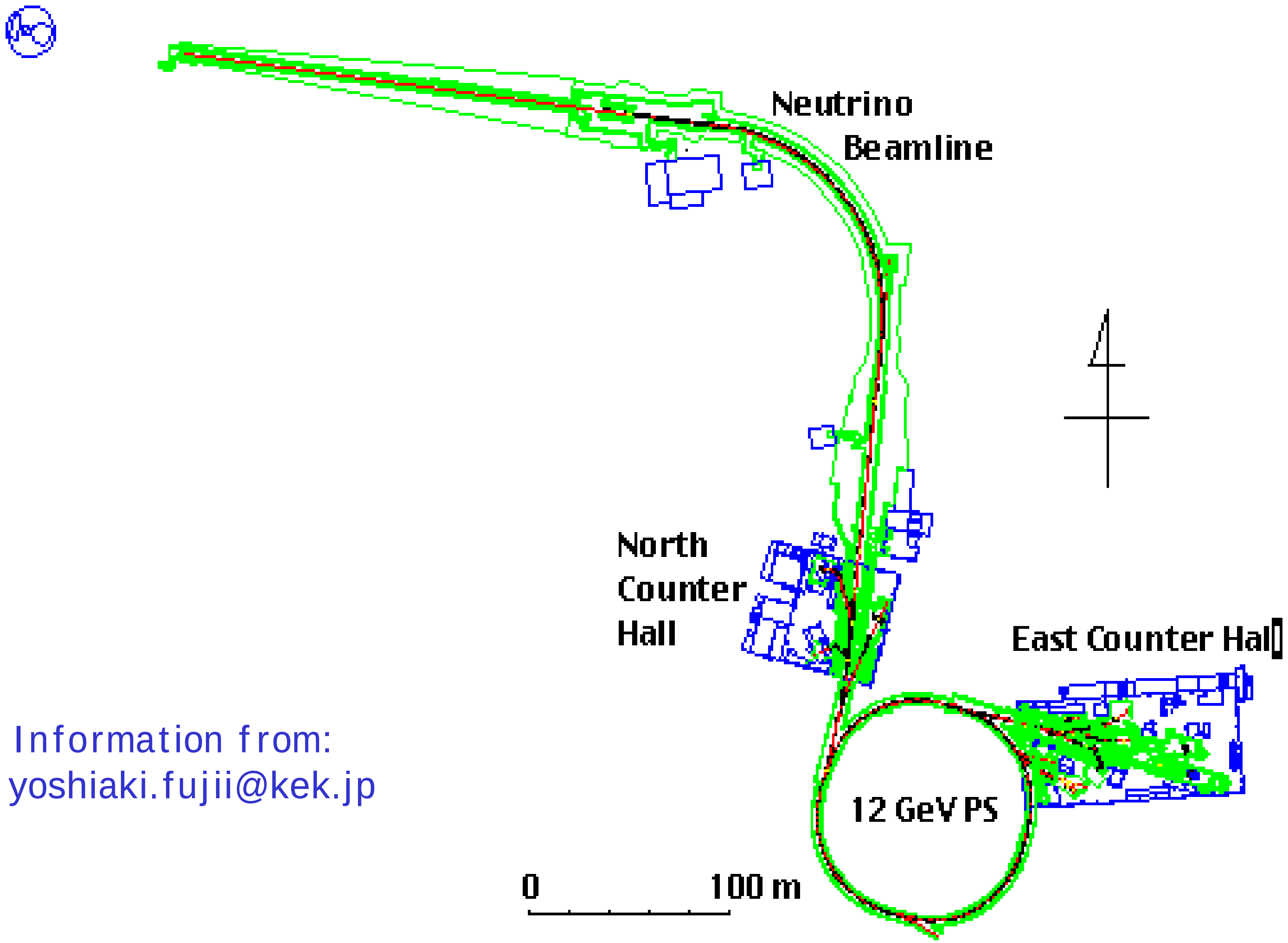
Gene Fisk – Fermilab
LCWS_2002 Jeju Do

Test Beams: Availability & Plans

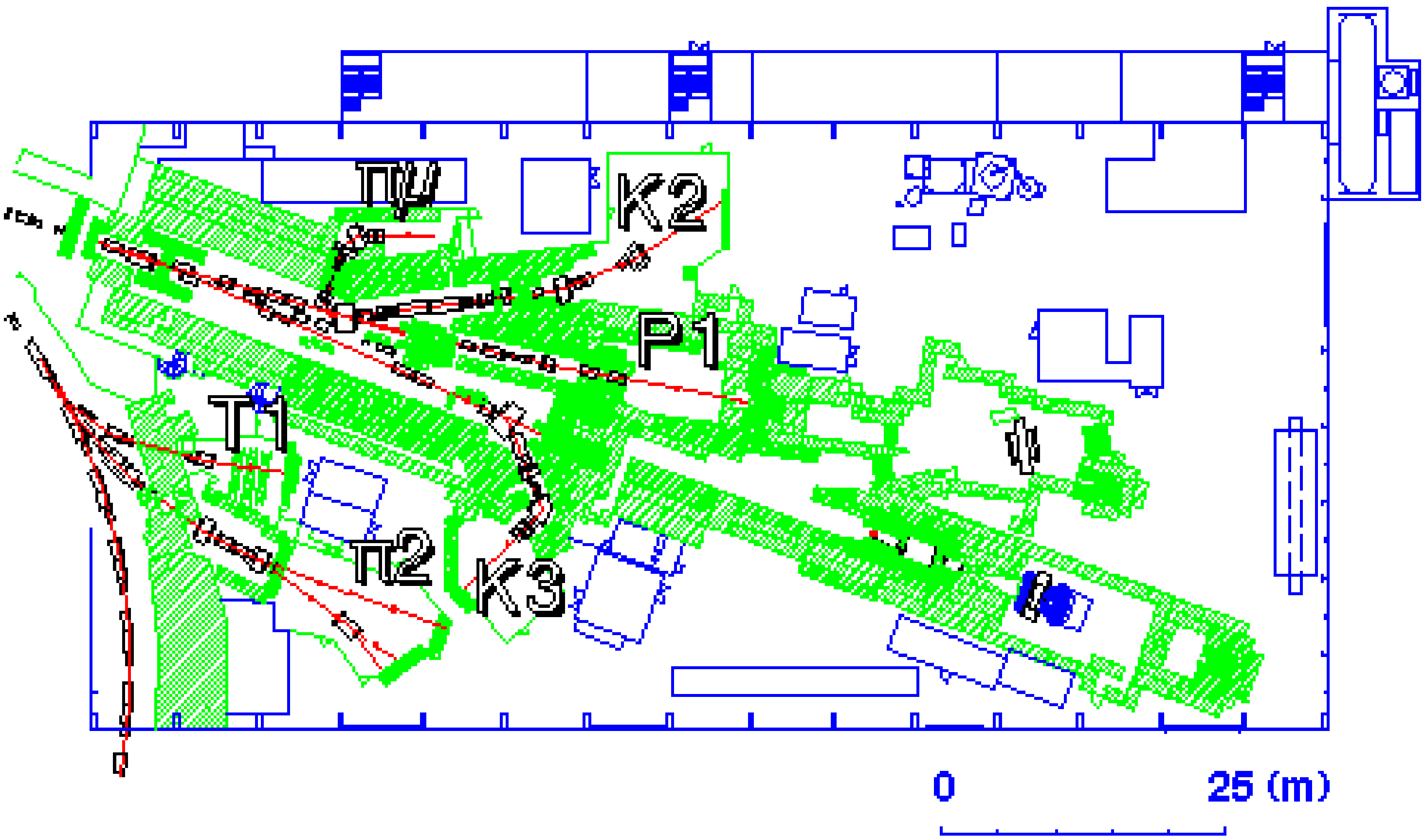
- **KEK**
- **DESY**
- **CERN**
- **Fermilab**
- **SLAC**
- **Other**

KEK Test Beams @ 12 GeV PS



Information from:
yoshiaki.fujii@kek.jp

KEK East Counter Hall



T1 and π2 Test Beams in the East Counter Hall

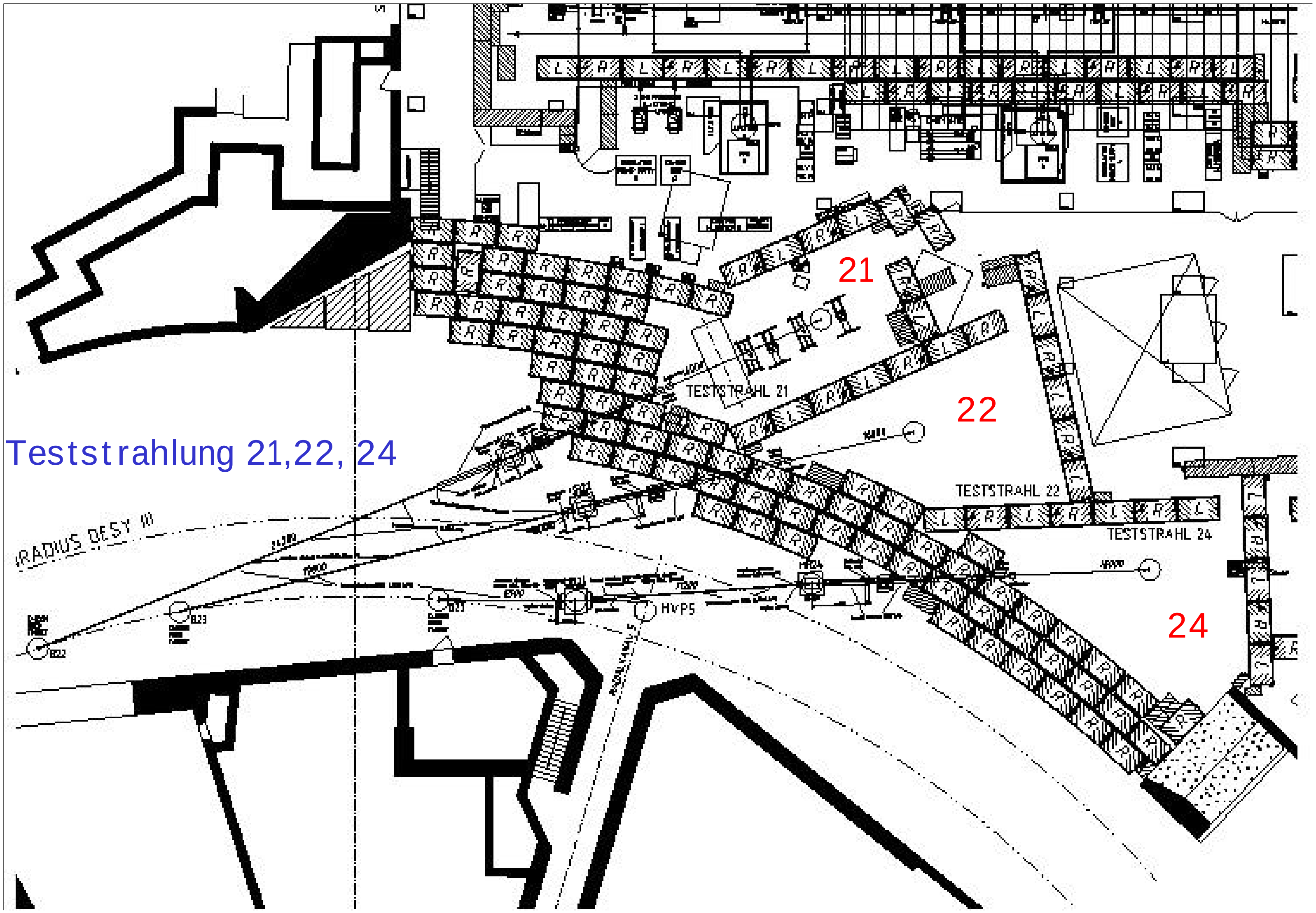
KEK Test Beams

KEK 12GeV-PS has two beamlines for beam tests:

#1 π2 (up to 4GeV) #2 T1 (up to 2GeV)

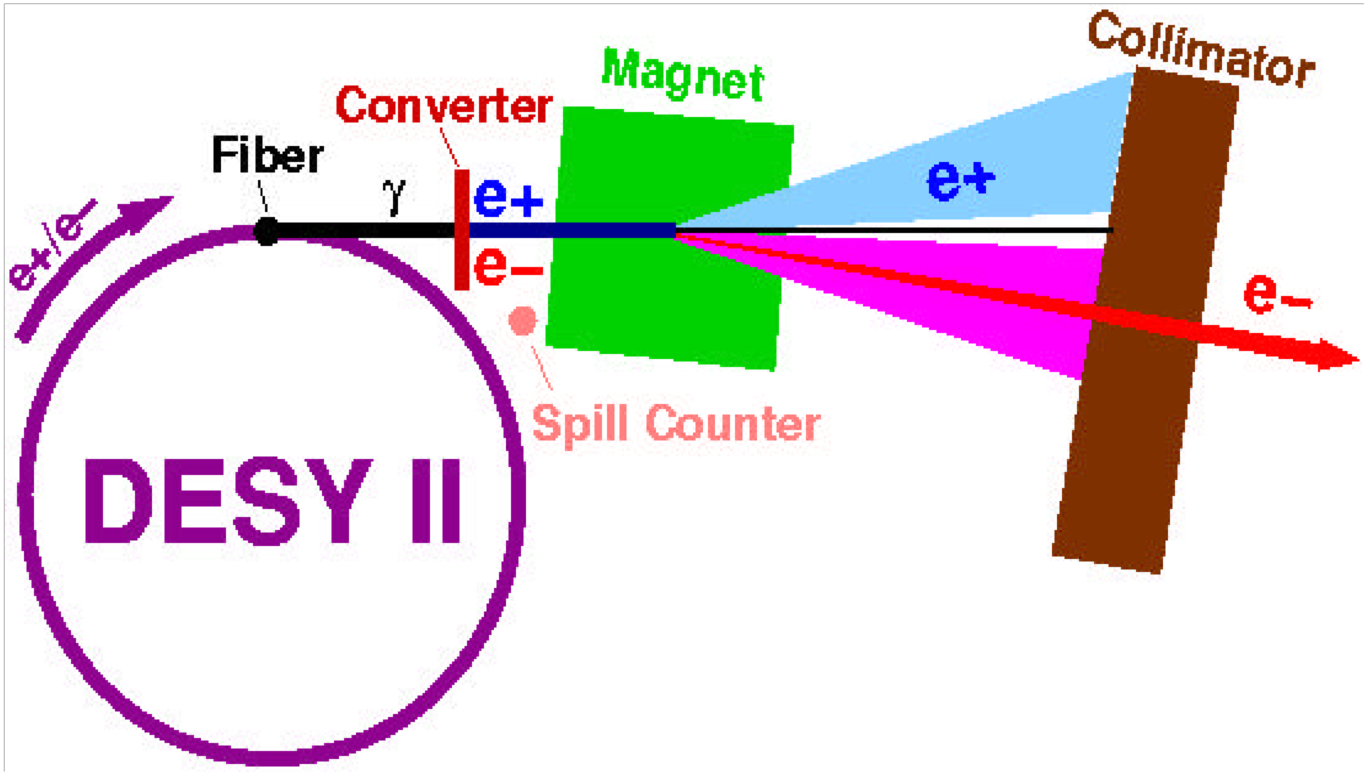
- Unseparated beams: $\Delta p/p \sim 1\%$(FWHM).
- Cerenkov counters exist for e/π separation.
- π2 has an additional momentum-analyzing magnet,
- while T1 does not.
- Facilities and support are not excellent for foreigners who cannot speak Japanese. Operation itself is easy.
- Beams are provided in October, November, and December every year until 2003 or 2004. Then they will be shut-off due to JHF construction.
- JLC-CAL will carry out beam tests in 2002 and 2003.

DESY Test Beams*



*Information from: N. Meyners
http://desyntwww.desy.de/~testbeam/welcome.html

DESY Test Beams



DESY Test Beams 21, 22, 24

Bremsstrahlung derived from in a carbon fiber in DESY II is converted to e+e- pairs in Cu, Al of thickness 1 – 10mm.

e+, e- momentum selection range: 1 – 6 GeV/c.

Intensity: max is ~ 1 kHz/cm^2 (avg)

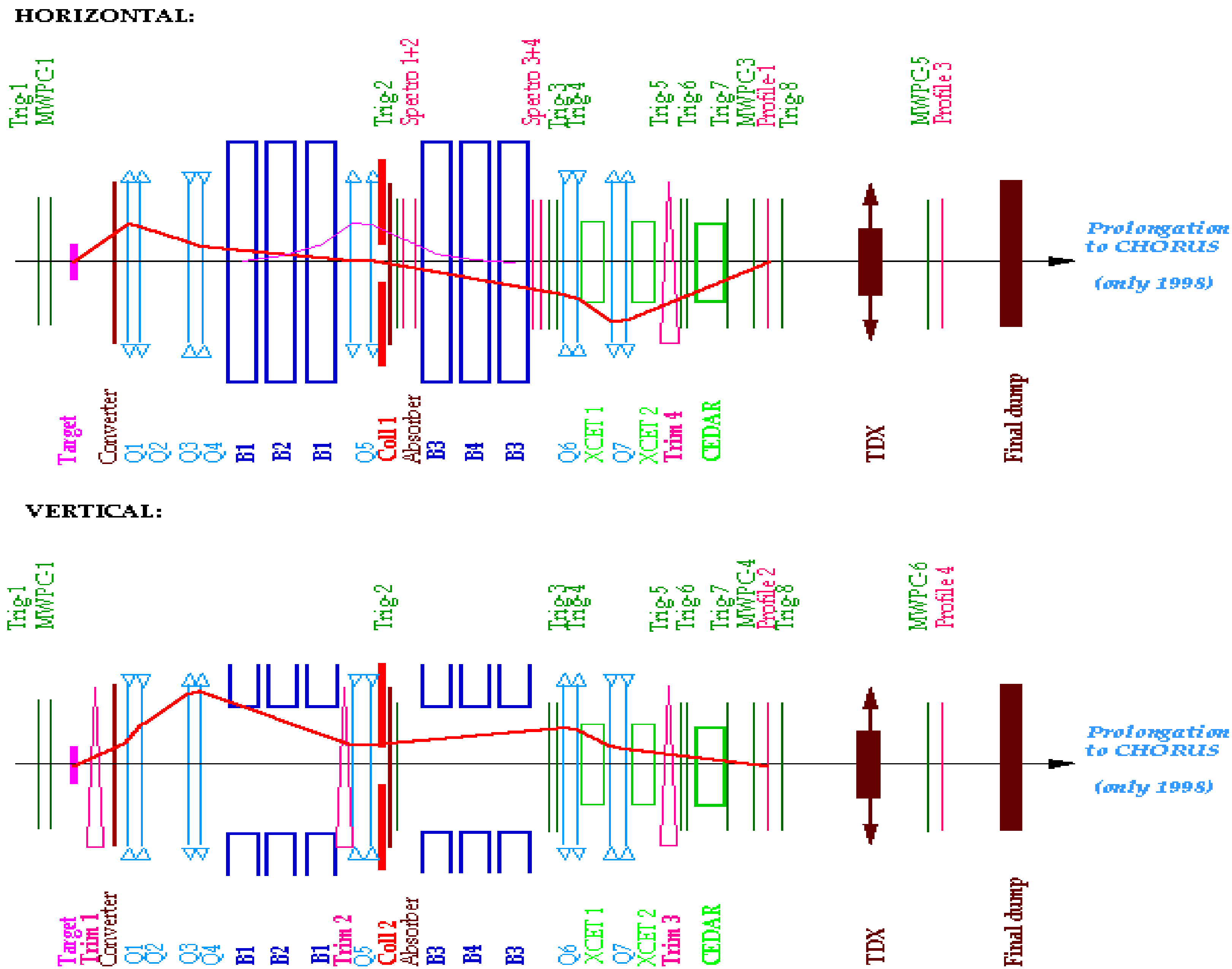
CERN Beam Lines*

West Area

Beam	Max.Momentum (GeV/c)	Intensity for 10^{12} incident protons at 450 GeV/c	Beam type
H3	250	~ 2 10^7 secondaries	Parent beam for X5,X7
X5	250	10^2-10^4 tertiaries/10^7 incident particles < 10^6 secondaries	Test beam: e, π, μ /w Gamma Irradiation Facility (GIF) Cs^{137} 720Bq bkgd source
X7	250	10^2-10^4 tertiaries/10^7 incident particles < 10^6 secondaries	Test beam: e, π, μ

*http://sl.web.cern.ch/SL/eagroup/beams.html
Information supplied by: K. Elsener, L. Gatignon, M. Hauschild

CERN X7 Test Beam



CERN Beam Lines

North Area

Beam	Max.Momentum (GeV/c)	Intensity for 10^{12} incident protons at 450 GeV/c	Beam type
H2	400	$9\ 10^7$ π+ at 200 GeV/c $3\ 10^7$ π- at 200 GeV/c $4\ 10^6$ e± at 150 GeV/c $1\ 10^5$ Pb at 400 GeV/Z	1) High-energy hadron or electron beam (also test beam) 2) Heavy ion beam
H4	450	π, e fluxes similar to H2 ~ 10^7 protons at 450 GeV/c ~ 10^7 Pb	1) High-energy hadron or electron beam 2) Attenuated primary beam 3) Heavy ion beam
H6	205	10^8 π+ at 150 GeV/c $4\ 10^7$ π- at 150 GeV/c	Medium energy hadron beam, also used to produce tertiary test beams

CERN Beam Lines

North Area (cont.)

Beam	Max.Momentum (GeV/c)	Intensity for 10^{12} incident protons at 450 GeV/c	Beam type
H8	450	~ 10^7 protons at 450 GeV/c 2 10^8 π + at 200 GeV/c 7 10^7 π at 200 GeV/c ~ 10^6 Pb at 400 GeV/Z	1) Attenuated primary or high-energy hadron (e±) beam or electron beam 2) Heavy ion beam
H2, H4, H6, H8		p_e < 250 GeV; high purity electron beams for CAL calib. p_h, p_μ < 350 GeV/c	
M2	225	2 10^7 μ+ at 100 GeV/c 3 10^6 μ - at 200 GeV/c	High-intensity (polarised) muon beam COMPASS
P41/61	450	< 10^{11} protons at 450 GeV/c > 5 10^7 Pb at 400 GeV/Z	Primary beam to transport protons or ions from T4 or T6 to ECN3 (NAHIF)
K12	450	10^7 K_L > 50 GeV/c 3 10^2 K_S > 50 GeV/c	Simultaneous KS and KL beams to ECN3

CERN Beam Lines - Future

West Area

Beam	Max.Momentum (GeV/c)	Intensity for 10^{12} incident protons at 450 GeV/c	Beam type
H3	250	~ 2 10^7 secondaries	Parent beam for X5,X7
X5	250	10^2-10^4 tertiaries/10^7 incident particles < 10^6 secondaries	Test beam: e, π, μ /w Gamma Irradiation Facility (GIF) Cs^{137} 720Bq bkgd source
X7	250	10^2-10^4 tertiaries/10^7 incident particles < 10^6 secondaries	Test beam: e, π, μ

X5, X7 operational in 2003, 2004;
No PS/SPS operation in 2005.
Under discussion: No West Area operation beyond 2006.

CERN Beam Lines - Future (cont.)

North Area

Beam	Max.Momentum (GeV/c)	Intensity for 10^{12} incident protons at 450 GeV/c	Beam type
H2	400	$9\ 10^{7}$ π+ at 200 GeV/c $3\ 10^{7}$ π- at 200 GeV/c $4\ 10^{6}$ e± at 150 GeV/c $1\ 10^{5}$ Pb at 400 GeV/Z	1) High-energy hadron or electron beam (also test beam) 2) Heavy ion beam
H4	450	π, e fluxes similar to H2 ~ 10^{7} protons at 450 GeV/c ~ 10^{7} Pb	1) High-energy hadron or electron beam 2) Attenuated primary beam 3) Heavy ion beam
H6	205	10^{8} π+ at 150 GeV/c $4\ 10^{7}$ π- at 150 GeV/c	Medium energy hadron beam, also used to produce tertiary test beams

Under consideration 2006 and beyond: Keep North Area test beams operational, but limit their use to no more than 2 at any time. Reduce maintenance to regular working hours. Keep COMPASS operational until 2008 at least.
Keep NA48 beam line dormant; possibly move GIF to it.

CERN Beam Lines Summary

6 Beam Lines at present

- West Area: X5(w GIF) & X7 100GeV e, 120 GeV μ,h
- North Area H2, H4, H6, H8 250 GeV e, 350 GeV μ,h

Future Plans:

- West Area test beams operate in 2003, 2004.
- No SPS or PS operation in 2005.
- Under consideration 2006 and beyond:
  Stop West Area test beams;
  Keep North Area test beams operational, but limit use to no more than 2 at any time. Reduce maintenance to regular working hours.
  Keep COMPASS operational until 2008 at least.
  Keep NA48 beam line dormant; possibly move GIF to it.

Fermilab Test Beams

Meson Lab Experimental Area

Meson Test Beam Facility http://www-ppd.fnal.gov/mtbf-w

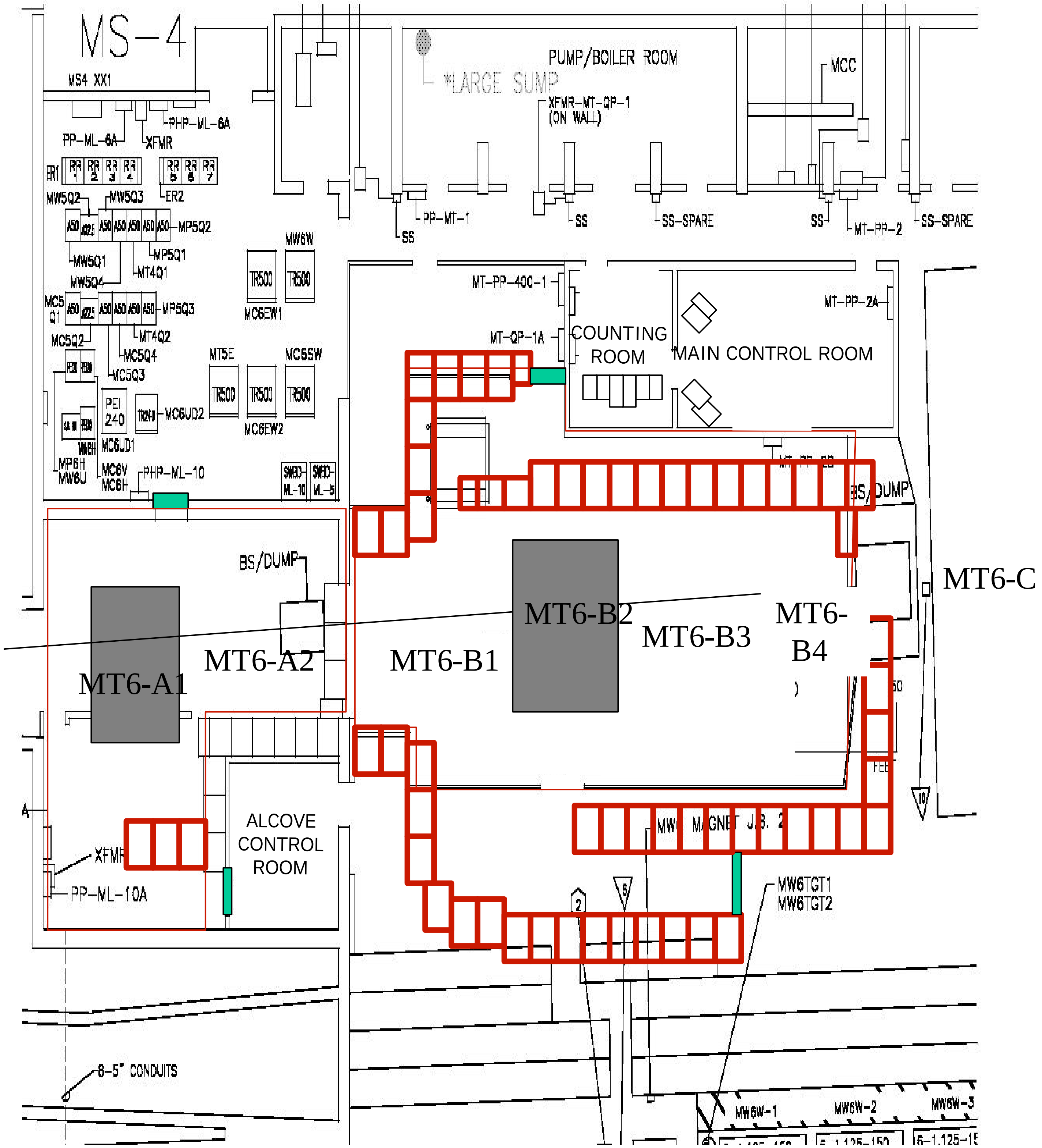
ramberg@fnal.gov

Meson Test Beam Facility

Mtest – the western-most beamline in the Meson building.

- User facilities: 6 areas – MT6A1 - 2 & MT6B1 – 4.
  Two locations are enclosed with A/C, etc. Gases, data and HV cables, trigger and DAQ are supported by the Lab.
- Type of beam: Secondaries from Main Injector 120 GeV protons on an Al target at 0°.
- Modes of operation:
  "Proton" ~1 MHz of 120 GeV protons.
  "Pion" ~50 kHz of 5 – 80 GeV secondaries (rate depends on E).
  e's ~ 10-20%, μ's ~ 5%, π's ~ 80%; neg. polarity poss.
- Beam size: 1 cm^2
- Instrumentation: 80' & 50' Cerenkov counters; 0.5 & 1.0 mm beam PWCs; etc.

MT6 Test Beam User Areas



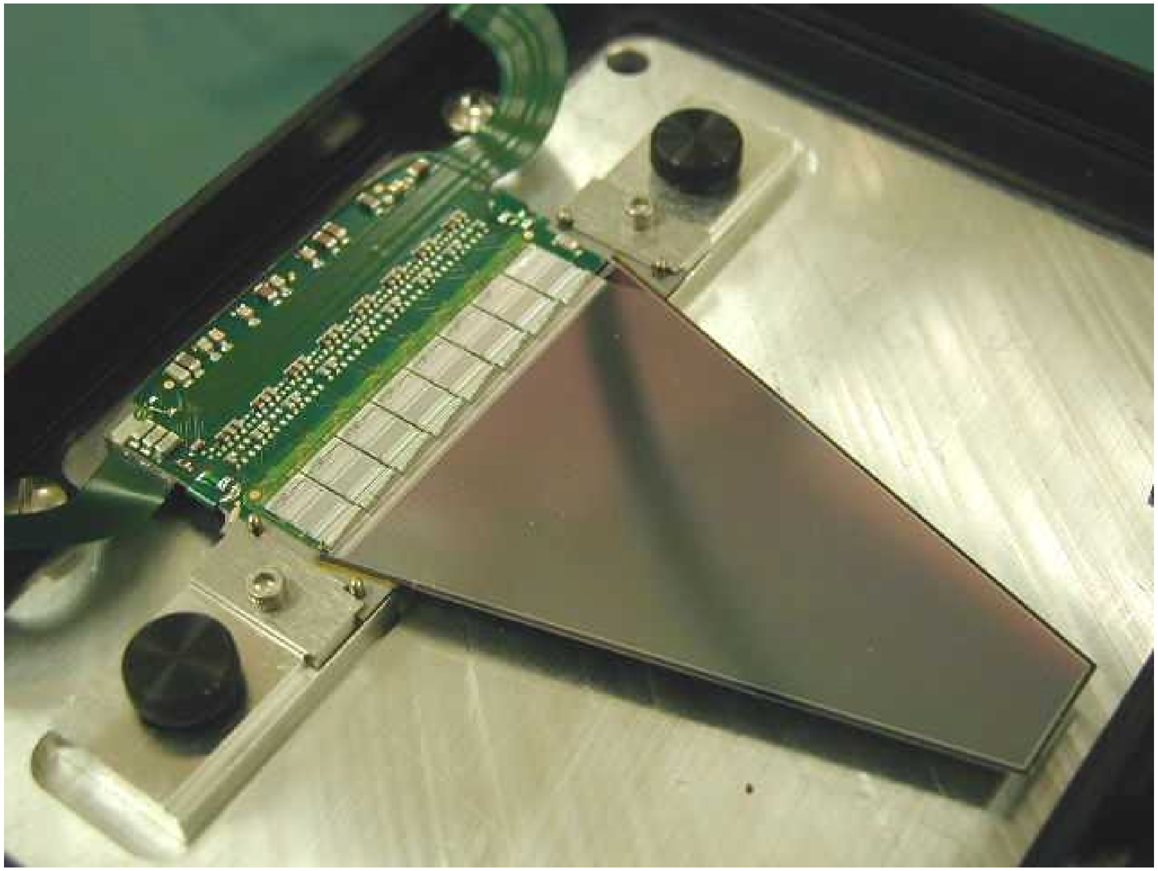
= Concrete = Enclosed climate control areas = Controlled access gate

Booster Radiation Damage Facility

- Energy = 8 GeV.
- 3 E11- 4.5 E12 protons/1.6 μs pulse, monitored with a toroid.
- Rep rate: 0.2 – 3 s depending on HEP demands.
- Circular beam size: FWHM = 1.2 cm measured with an MWPC.
- Temperature controlled box (e.g. 5ºC).
- Motorized table.

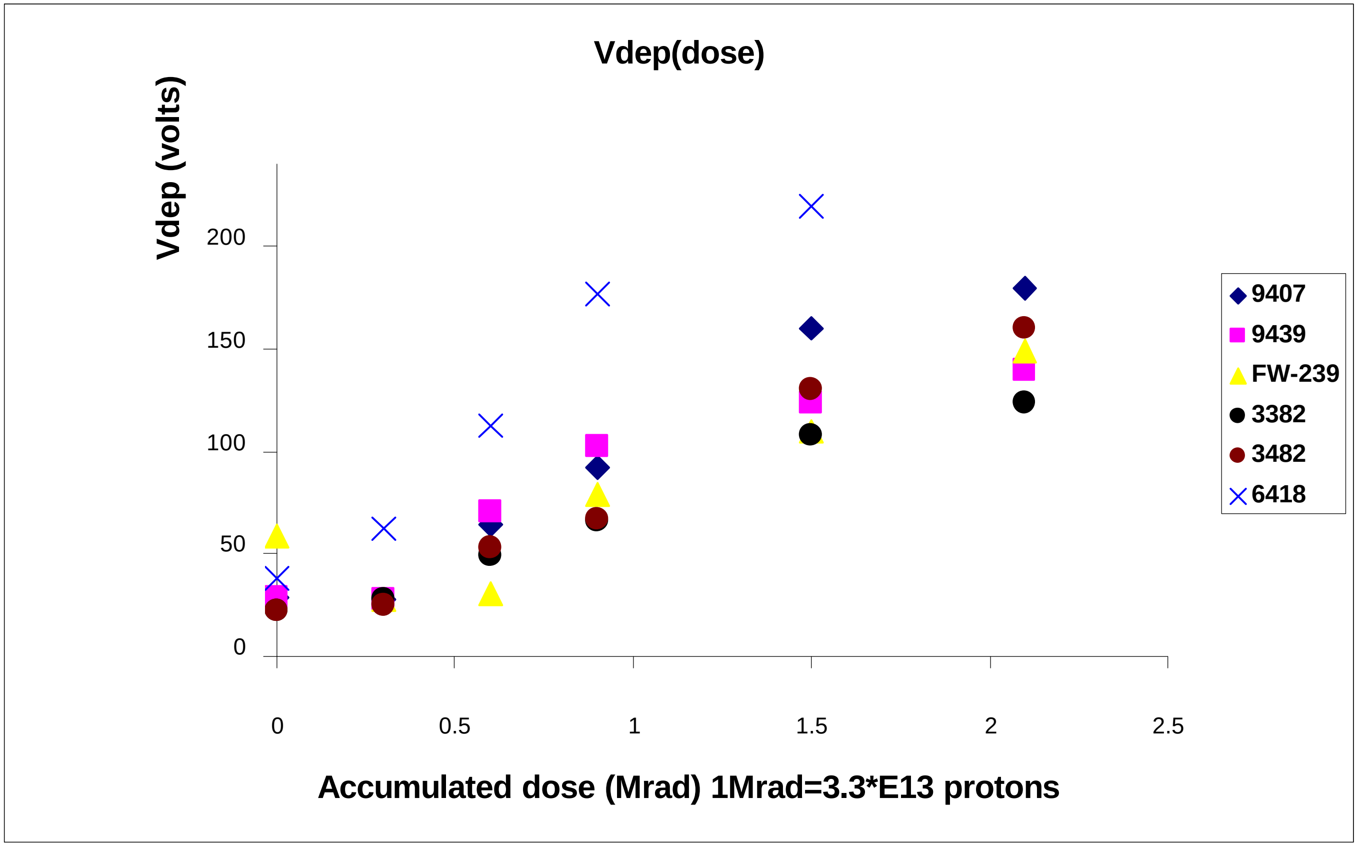
- In a D0 test of Run 2 Si micro-strips a total dose of 2.1 Mrads (~7 E13 protons/cm2) was delivered to measure:
  1. depletion voltage
  2. Leakage current
  3. <noise>
  4. # of noisy channels, etc.

Booster Radiation Damage Facility



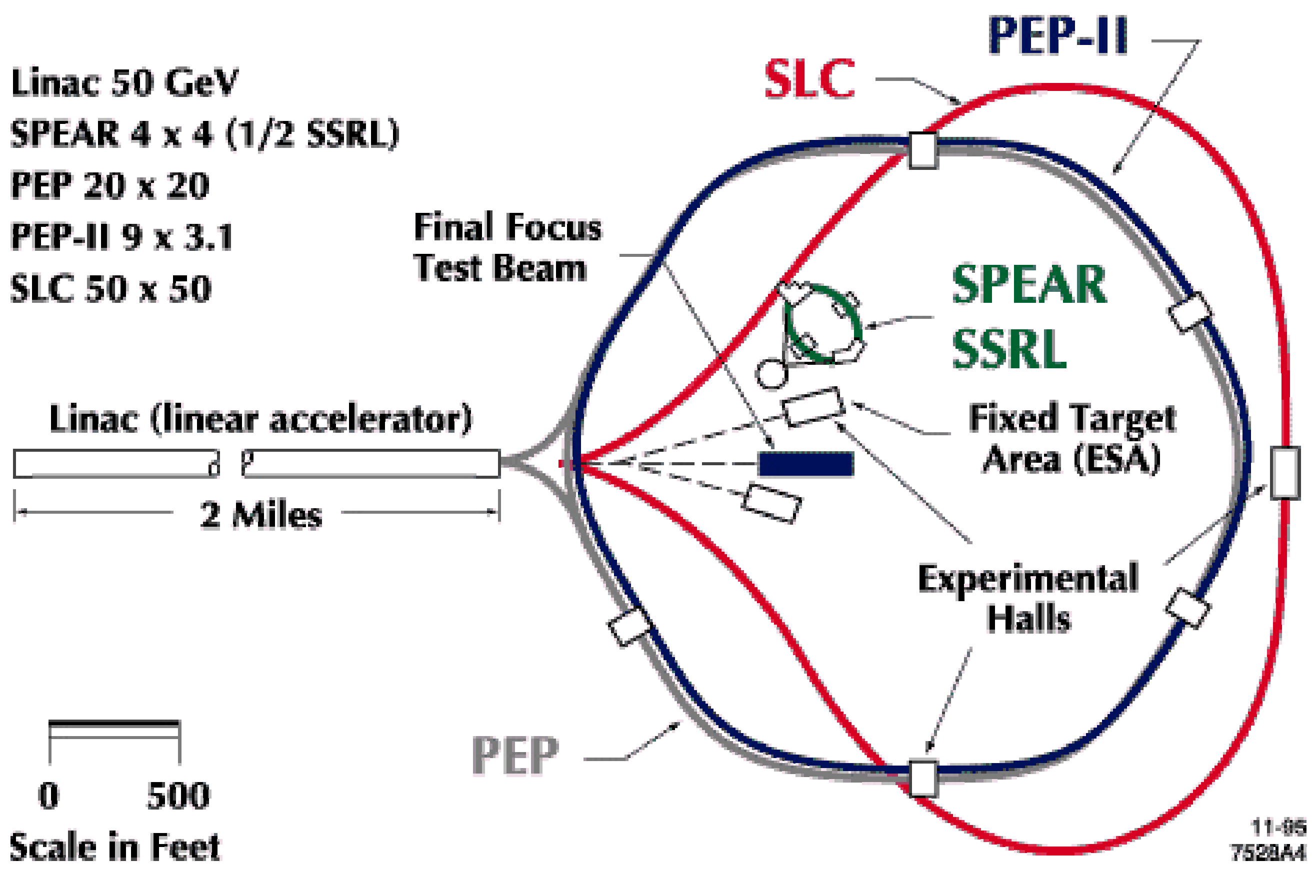
D0 forward disk Si micro-strip wedge detector

Booster Radiation Damage Facility



SLAC

Experimental Areas at SLAC



SLAC Final Focus Test Beam

SLAC test beam line -- FFTB

There are three possible modes of operation. All provide beam pulses ~ 6ps long at 1 - 30 Hz depending on the accelerator program:

a) Low intensity electron or positron

Typical momentum range 5 - 20 GeV.

Up to a few x 10^3 particles per pulse, depending on momentum.

Space presently available ~1 m to south of beam line, ~2 m to north, ~1 m above and below, ~2m along beam line.

SLAC FFTB (cont.)

b) High intensity electron or positron. Available for very thin materials in vacuum or in some cases in air.

Momentum = 28.5 GeV

10^9 to 2×10^{10} per pulse (down to 10^7 under development).

Various possible experimental stations, all with substantial space constraints.

c) Bremsstrahlung beam

Peak energy 28.5 GeV

Radiator up to 0.02 X_o for 10^{10} /pulse electron beam

Electron beam pipe passes 30-35 cm below the gamma ray beam at the experimental station.

SLAC FFTB (cont.)

Space on either side or above ~1 m; along beam line ~2 m.

In all cases, when the beam is being delivered there is no physical access to the experimental equipment.

Tests have also been carried out in recent years in End Station A, where however, the competing experimental program is very full, and it is harder to get time. A tagged Bremsstrahlung beam has been used, as has a very low intensity positive hadron beam. When space and time are available at all, there are usually few space constraints on test apparatus in End Station A.

For further information, or possible extensions of the above specifications, contact the Test Beam Coordinator, Ted Fieguth fieguth@slac.stanford.edu

More Test Beams around the World

Argonne: No test beams.
Brookhaven: No test beams.
Cornell: CHESS x-rays useful for some kinds of radiation damage studies.
Daresbury: No test beams
Frascati: 0.51 GeV e- beam from their 50 Hz linac; 1 – 1 E4 e's/pulse.
IHEP – Beijing:
IHEP – Serpukhov:
JINR:
LAL Orsay: No test beams.
Novosibirsk/BINP:
RAL: No test beams.
Saclay: No test beams.
TRIUMF:

If you have information on test beams that should be included in the LCWS2002 proceedings send it via E-mail to:
hefisk@fnal.gov

Summary

- There are significant test beams at most of our laboratories.
- Many of you at this meeting include plans to use these test beams in your detector R&D.
- Most of the facilities require attention by us to make them more user friendly and applicable to our needs.
- As hardware and software prototypes are developed, and test beam results become available, they will have a significant impact on the research tool we are building.
- Studies are good; detectors based on tests are better!